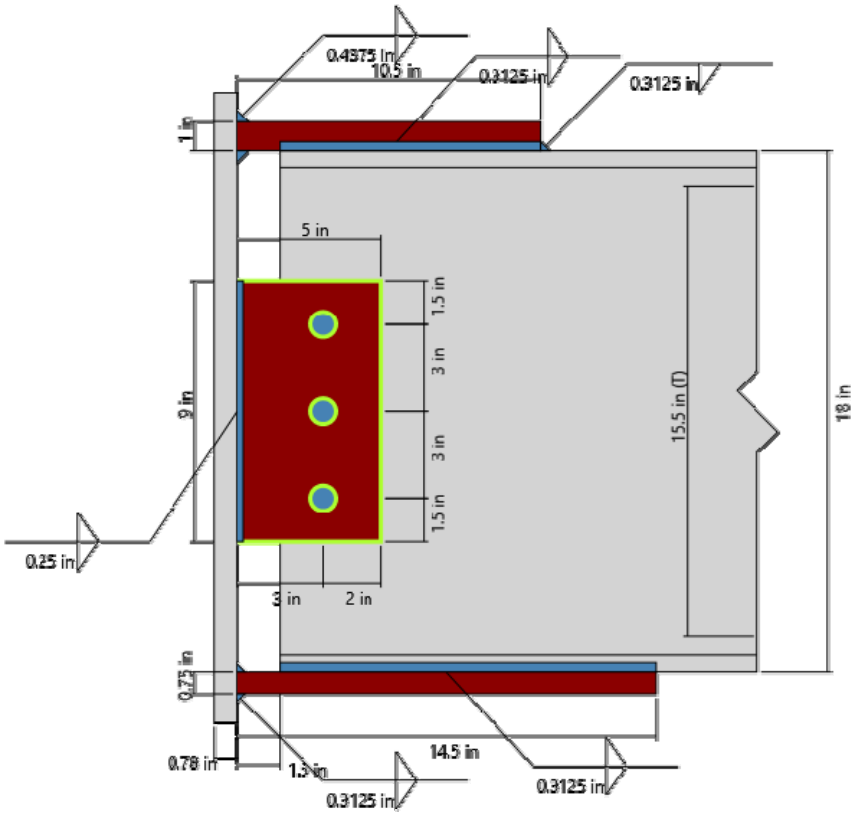
# Design Summary: Welded Flange Plate




**Top Plate Design:**
Width = 6 in
Fy = 36 Ksi
Fu = 58 Ksi

**Bottom Plate Design:**
Width = 8.75 in
Fy = 36 Ksi
Fu = 58 Ksi

**Support Design:**
Thickness = 0.78 in
Fy = 50 Ksi
Fu = 65 Ksi

**Bolt Design:**
Type = Group A
Diameter = 0.875 in
Thread = N

**Shear Tab Design:**
Thickness = 0.375 in
Fy= 36 Ksi
Fu= 58 Ksi

**Steel Specification:**
AISC 360-16

**Beam Design:**
bf = 7.5 in
tf = 0.57 in
tw = 0.355 in
Fy = 50 Ksi
Fu = 65 Ksi

| Limit State | Load Key | Demand | Capacity | Unity Value |
|---|---|---|---|---|
| Bolt Group Shear | 1 | 42 K | 73.06 K | 0.575 |
| Bolt Group Bearing - Beam Web | 1 | 42 K | 136.29 K | 0.308 |
| Bolt Group Bearing - Tab | 1 | 42 K | 75.7 K | 0.555 |
| Fillet Weld - Tab to Support | 1 | 42 K | 100.23 K | 0.419 |
| Base Metal - Support | 1 | 42 K | 410.67 K | 0.102 |
| Base Metal - Tab | 1 | 42 K | 72.9 K | 0.576 |
| Block Shear - Tab | 1 | 42 K | 70.031 K | 0.600 |
| Shear Yield - Tab | 1 | 42 K | 72.9 K | 0.576 |
| Shear Rupture - Tab | 1 | 42 K | 58.725 K | 0.715 |
| Tension Yield - Top Plate | 1 | 166.89 K | 194.4 K | 0.858 |
| Tension Rupture - Top Plate | 1 | 166.89 K | 261 K | 0.639 |
| Compression Buckling - Top Plate | 0 | 0 K | 194.28 K | 0.000 |
| Block Shear - Top Plate to Flange | 1 | - | - | 0.000 |
| Fillet Weld - Top Plate to Flange | 1 | 166.89 K | 169.14 K | 0.987 |
| Base Metal - Top Flange | 1 | 166.89 K | 405.14 K | 0.412 |
| Base Metal - Top Plate | 1 | 166.89 K | 524.88 K | 0.318 |
| Weld - Top Plate to Support | 1 | 166.89 K | 175.41 K | 0.951 |
| Base Metal - Top Plate to Support | 1 | 166.89 K | 194.4 K | 0.858 |
| Tension Yield - Bottom Plate | 0 | 0 K | 212.63 K | 0.000 |
| Tension Rupture - Bottom Plate | 0 | 0 K | 249.55 K | 0.000 |
| Compression Buckling - Bottom Plate | 1 | 166.89 K | 212.4 K | 0.786 |
| Block Shear - Bottom Plate to Flange | 1 | - | - | 0.000 |
| Fillet Weld - Bottom Plate to Flange | 1 | 166.89 K | 180.98 K | 0.922 |
| Base Metal - Bottom Flange | 1 | 166.89 K | 433.49 K | 0.385 |
| Base Metal - Bottom Plate | 1 | 166.89 K | 421.2 K | 0.396 |
| Weld - Bottom Plate to Support | 1 | 166.89 K | 182.72 K | 0.913 |
| Base Metal - Bottom Plate to Support | 1 | 166.89 K | 399.26 K | 0.418 |
| Welded Flange Plate Detailing | - | - | - | OK |

# Welded Flange Plate: Detailed Reports

## Tension Yield - Top Plate(AISC 360-16 J4.1.a)

Load Set: Load Set 1 Load Combination: 1.2D + 1.6L
Demand: Ru = 166.89 K
Capacity: $\phi Rn = \phi \cdot Fy \cdot b \cdot t = 0.90 \cdot 36$ Ksi $\cdot 6$ in $\cdot 1$ in = 194.4 K
Unity = Ru / $\phi$Rn = 166.89 K / 194.4 K = **0.858**

## Fillet Weld - Top Plate to Flange (AISC 360-16 J2.4)

Load Set: Load Set 1  Load Combination: 1.2D + 1.6L
Demand:  Ru = 166.89 K
Weld:  Size = 0.3125 in  Fexx = 70 Ksi
  Longitudinal Length = 9 in  Transverse Length = 6 in
  Rn_wl = 167.05 K  Rn_wt = 55.685 K  Weld Unit Capacity = 111.37 K/ft
  ϕRn = Phi · Max(Rn_wl + Rn_wt, 0.85·Rnwl + 1.5·Rnwt) (Equation J2-6a & J2-6b)
  ϕRn = Phi · Max(167.05 K + 55.685 K, 0.85·167.05 K + 1.5·55.685 K)
  ϕRn = 169.14 K (Equation J2-6a & J2-6b)
Unity = Ru / ϕRn = 166.89 K / 169.14 K = **0.987**

## Weld - Top Plate to Support (AISC 360-16 J2.4)

Load Set: Load Set 1  Load Combination: 1.2D + 1.6L
Demand:  Ru = 166.89 K
Fillet Weld: Size = 0.4375 in  Fexx = 70 Ksi  Weld Length = 6 in  Theta = 90 deg
  Weld Line Count = 2  Weld Unit Capacity = 233.88 K/ft
  ϕRn = Phi · 0.6 · Fexx · (1.0 + 0.5 · sin(Theta)^1.5) (Equation J2-4)
  ϕRn = 0.75 · 0.6 · 70 Ksi · (1.0 + 0.5 · sin(90 deg)^1.5)
  ϕRn = 175.41 K
Unity = Ru / ϕRn = 166.89 K / 175.41 K = **0.951**

## Base Metal - Top Plate to Support (AISC Part 9 & 360-16 J2.4)

Load Set: Load Set 1  Load Combination: 1.2D + 1.6L
Demand: Ru = 166.89 K (Tension)
Weld: Weld Length = 6 in

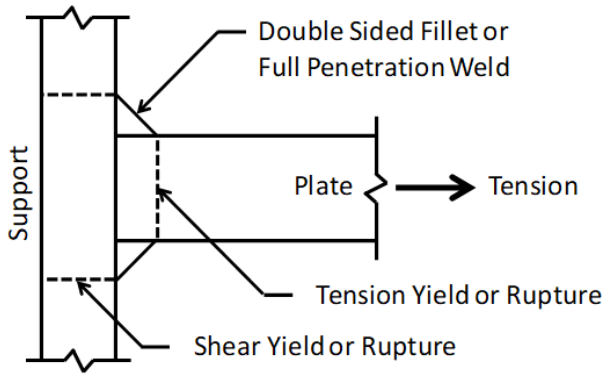



Plate: Fy = 36 Ksi  Fu = 58 Ksi  t = 1 in
  Tensile Yield: ϕRn_ty = 0.9·Fy·t·WeldLength = 194.4 K (Equation J4-1)
  Tensile Rupture: ϕRn_tr = 0.75·Fu·t·WeldLength = 261 K (Equation J4-2)
  Capacity: ϕRn1 = Min(ϕRn_ty, ϕRn_tr) = 194.4 K
Support: Fy = 50 Ksi  Fu = 65 Ksi  t = 0.78 in
  Shear Yield: ϕRn_vy = 1.0·0.6·Fy·t·Weld Length·2 = 280.8 K (Equation J4-3)
  Shear Rupture: ϕRn_vr = 0.75·0.6·Fu·t·Weld Length·2 = 273.78 K (Equation J4-4)
  Capacity: ϕRn2 = Min(ϕRn_vy, ϕRn_vr) = 273.78 K
Unity = Ru / Min(ϕRn1, ϕRn2) = 166.89 K / 194.4 K = **0.858**

### Compression Buckling - Bottom Plate (AISC 360-16 E3)

Load Set: Load Set 1  Load Combination: 1.2D + 1.6L
Demand: Ru = 166.89 K
Plate: Fy = 36 Ksi  Thickness = 0.75 in  Ag = 6.5625 in^2  K = 0.65  L = 1.5 in  r = 0.21651 in
Capacity:
KL/r = 4.503  Fe = 14113 Ksi (Equation E3-4)  Fcr = 35.962 Ksi (Equation E3-2)
ϕRn = ϕ·Ag·Fcr = 0.90 · 6.5625 in^2 · 35.962 Ksi = 212.4 K
Unity = 166.89 K / 212.4 K = **0.786**

### Fillet Weld - Bottom Plate to Flange (AISC 360-16 J2.4)

Load Set: Load Set 1  Load Combination: 1.2D + 1.6L
Demand:  Ru = 166.89 K
Weld:  Size = 0.3125 in  Fexx = 70 Ksi
Longitudinal Length = 13 in  Transverse Length = 0 in
Rn_wl = 241.3 K  Rn_wt = 0 K  Weld Unit Capacity = 111.37 K/ft
ϕRn = Phi · Max(Rn_wl + Rn_wt, 0.85·Rnwl + 1.5·Rnwt) (Equation J2-6a & J2-6b)
ϕRn = Phi · Max(241.3 K + 0 K, 0.85·241.3 K + 1.5·0 K)
ϕRn = 180.98 K (Equation J2-6a & J2-6b)
Unity = Ru / ϕRn = 166.89 K / 180.98 K = **0.922**

## Load Combinations

| Code | Name | Effective Equation |
|---|---|---|
| ASCE 7-16 LRFD | 1. 1.4D | 1.4D |
| ASCE 7-16 LRFD | 2. 1.2D+1.6L+0.5Lr | 1.2D + 1.6L |
| ASCE 7-16 LRFD | 3. 1.2D+1.6Lr+L | 1.2D + 0.5L |

## Design Loads

| Load Key | Fvu (K) | Fau (K) | Mzu (K-ft) |
|---|---|---|---|
| 0 | -9.8 | 0 | -58.8 |
| 1 | -42 | 0 | -252 |
| 2 | -18.9 | 0 | -113.4 |